Claims

We claim:

1. An electrical structure, comprising:

a first substrate;

a first conductive body mechanically and electrically coupled to the first substrate;

a nonsolderable and nonconductive material, wherein the nonsolderable and nonconductive material volumetrically surrounds and contacts a first portion of a surface of the first conductive body such that a second portion of the surface of the first conductive body is not contacted by the nonsolderable and nonconductive material;

a second conductive body mechanically and electrically coupled to the first conductive body by surface adhesion at the second portion of the surface of the first conductive body, wherein a melting point of the second conductive body is less than a melting point of the first conductive body; and

a second substrate mechanically and electrically coupled to the second conductive body.

2. The electrical structure of claim 1, wherein the first conductive body includes a solder bump.

3. The electrical structure of claim 2, wherein a height of the second conductive body is at least about 50% of a height of the solder bump.

4. The electrical structure of claim 2, wherein an area of the first portion of the surface of the first conductive body exceeds an area of the second portion of the surface of the first conductive body by a factor of at least about 10.

5. The electrical structure of claim 1, wherein a height of the second conductive body is at least about 3 mils.

6. The electrical structure of claim 1, wherein the nonsolderable and nonconductive material selected from the group consisting of a polyimide, a photosentive resin, an epoxy, and a silicone.

7. The electrical structure of claim 1, further comprising an encapsulating material between the nonsolderable and nonconductive material and the second substrate, wherein the encapsulating material encapsulates the second conductive body.

8. The electrical structure of claim 7, wherein the encapsulating material includes epoxy anhydride with silica filler.

9. The electrical structure of claim 1, wherein the melting point of first conductive body exceeds the melting point of the second conductive body by no more than about 147 °C.

10. The electrical structure of claim 1, wherein the second conductive body includes lead and tin in a eutectic lead/tin ratio.

11. The electrical structure of claim 1, wherein the second conductive body includes lead and tin in lead/tin ratio that exceeds a eutectic lead/tin ratio.

12. The electrical structure of claim 1, wherein the second substrate includes an organic material.

13. The electrical structure of claim 1, wherein the second substrate includes a ceramic material.

14. The electrical structure of claim 1, further comprising a second nonsolderable and nonconductive coating material, wherein a first portion of a surface of the second conductive body is coated by the second nonsolderable and nonconductive coating material such that a second portion of the surface of the second conductive body is not contacted by the second nonsolderable and nonconductive coating material, and wherein

the second portion of the surface of the second conductive body is mechanically and electrically coupled to the second portion of the surface of the first conductive body.

15. The electrical structure of claim 14, wherein the second nonsolderable and nonconductive coating material includes a cured light-sensitive resin.

16. The electrical structure of claim 1, wherein the first substrate includes a chip, and wherein the second substrate includes a chip carrier or a circuit card.

17. The electrical structure of claim 1, wherein the first substrate includes a chip or a module, and wherein the second substrate includes a circuit card.

18. An electrical structure, comprising:

a first substrate;

a first conductive body mechanically and electrically coupled to the first substrate;

a nonsolderable and nonconductive material, wherein the nonsolderable and nonconductive material volumetrically surrounds and contacts a first portion of a surface of the first conductive body such that a second portion of the surface of the first conductive body is not contacted by the nonsolderable and nonconductive material;

a second conductive body;

means for mechanically and electrically coupling the second conductive body to the first conductive body by surface adhesion at the second portion of the surface of the first conductive body, wherein said coupling means includes means for applying a temperature to the first conductive body and the second conductive body, wherein the temperature is below a melting point of the first conductive body, and wherein the temperature is not below a melting point of the second conductive body; and

a substrate mechanically and electrically coupled to the second conductive body.

19. A method for forming an electrical structure, comprising the steps of:

providing a first structure, including a first substrate, a first conductive body mechanically and electrically coupled to the first substrate, and a nonsolderable and nonconductive material, wherein the nonsolderable and nonconductive material volumetrically surrounds and contacts a first portion of a surface of the first conductive body such that a second portion of the surface of the first conductive body is not contacted by the nonsolderable and nonconductive material;

providing a second structure, including a second substrate and a conductive bump mechanically and electrically coupled to the second substrate;

placing the second structure in contact with the first structure such that the conductive bump is in contact with the second portion of the surface of the first conductive body;

reflowing the conductive bump without melting any portion of the first conductive body to form a second conductive body, wherein the second conductive body covers the second portion of the surface of the first conductive body; and

cooling the first structure and the second structure to solidify the second conductive body and to mechanically and electrically couple the second conductive body to the first conductive body by surface adhesion at the second portion of the surface of the first conductive body.

20. The method of claim 19, wherein the first conductive body includes a solder bump.

21. The method of claim 19, wherein the second conductive body formed in the reflowing step has a height of at least about 3 mils.

22. The method of claim 19, further comprising filling a space between the nonsolderable and nonconductive material and the second substrate with an encapsulating material, wherein the encapsulating material encapsulates the second conductive body.

23. The method of claim 22, wherein the encapsulating material includes epoxy anhydride with silica filler.

24. The method of claim 19, further comprising prior to the placing step, removing a portion of the nonsolderable and nonconductive material from the first conductive body to form an exposed surface of the first conductive body, wherein the second portion of the surface of the first conductive body in the placing step includes the exposed surface.

25. The method of claim 24, wherein the removing step includes laser ablating a portion of the nonsolderable and nonconductive material that contacts the first portion of a surface of the first conductive body in the providing step.

26. The method of claim 19, wherein the nonsolderable and nonconductive material selected from the group consisting of a polyimide, a photosentive resin, an epoxy, and a silicone.

27. The method of claim 19, wherein the nonsolderable and nonconductive material includes a cured light-sensitive resin.

28. The method of claim 19, wherein the nonsolderable and nonconductive material does not melt during the reflowing step.

29. The method of claim 19, further comprising providing a nonsolderable and nonconductive coating material on a first portion of a surface of the second conductive body such that a second portion of the surface of the second conductive body is not contacted by the nonsolderable and nonconductive coating material, and wherein the second portion of the surface of the second conductive body is mechanically and electrically coupled to the second portion of the surface of the first conductive body.

30. The method of claim 29, wherein the second nonsolderable and nonconductive coating material includes a cured light-sensitive resin.

31. The method of claim 19, wherein a height of the second conductive body is at least about 50% of a height of the first conductive body.

32. The method of claim 19, wherein an area of the first portion of the surface of the first conductive body exceeds an area of the second portion of the surface of the first conductive body by a factor of at least about 10.

33. The method of claim 19, wherein the melting point of first conductive body exceeds the melting point of the second conductive body by no more than about 147 °C.

34. The method of claim 19, wherein the second conductive body includes lead and tin in a eutectic lead/tin ratio.

35. The method of claim 19, wherein the second conductive body includes lead and tin in lead/tin ratio that exceeds a eutectic lead/tin ratio.

36. The method of claim 19, wherein the second substrate includes an organic material.

37. The method of claim 19, wherein the second substrate includes a ceramic material.

38. The method of claim 19, wherein the first substrate includes a chip, and wherein the second substrate includes a module or a circuit card.

39. The method of claim 19, wherein the first substrate includes a chip or a module, and wherein the second substrate includes a circuit card.